

## A Note on the Contribution of Hepatopancreas to the Development of Oocytes in the Scorpion (*Palamnaeus bengalensis*)

Among Arthropods, the hepatopancreas has been subjected to comprehensive studies only in respect of crustacea. In these animals, the hepatopancreas is taken to perform three-fold functions, viz. secretory, absorptive and excretory. This gland had been seen to accumulate a large quantity of substances which are stored as reserve food. In Arachnids, the functional aspects of hepatopancreas remain to be investigated in detail. In the scorpion, *Palamnaeus bengalensis*, it is blackish in hue occupying considerable space of the mesosoma and is intimately associated with the reproductive organ. Taking the growing body of evidence into consideration that prior to and during the onset of vitellogenesis some of the precursors of yolk manufactured elsewhere are incorporated by the oocytes, the present study has been undertaken with a view to unfold the possible role of hepatopancreas of *P. bengalensis* in supplying the extra oocyte precursors of yolk and other nutritive substances to the developing oocytes.

Small pieces of hepatopancreas were fixed in the following fixatives: Carnoy, 10% neutral formalin, Eftman and 5% silver nitrate at pH 5. The sections of 10% neutral formalin were subjected to PERL's potassium/ferrocyanide test for ferritin. The melanin was demonstrated by ferrous iron technique and the tyrosine by MILLON reaction (BENSELY and GERSCH modification). Sulfhydryl groups were detected by the (3) ferric/ferricyanide method for SH (CHÈVREMENT and FRÉDERIC, 1943)<sup>1</sup>.

The ferritin granules were seen to be loosely scattered in the section of the gland (Figure). The interlobular spaces however showed marked concentration of ferritin. The storage of iron in the hepatopancreas in the ferric state is of interest since most of the investigations made on hepatopancreas have recorded iron in the ferrous state<sup>2</sup>. The amount of ferritin which is usually regarded as poorly stored material, in hepatopancreas of *P. bengalensis* appears to be regulated by the ascorbic acid content of the gland. In view of the assumption that the stored ferritin might be utilized by some other tissues, the ovary and developing oocytes have been examined. The ovarian tubes did not contain any ferritin but the oocytes

showed the presence of such granules. The young oocytes while still hemmed in by the nurse cells appeared to contain little of ferritin granules, but as the oocytes grew and embarked upon vitellogenesis, the amount of this iron-protein increased considerably. In mature oocytes the ferritin granules were seen in between and also upon the yolk platelets. When oocytes started incorporating ferritin granules, the latter were observed on both outer and inner faces of the oocyte membrane indicating thereby that their uptake was done by a process akin to pinocytosis. The deposition of ferritin in the hepatopancreas and its subsequent appearance in the developing oocytes points to the fact that the source of ferritin for oocytes is the hepatopancreas.

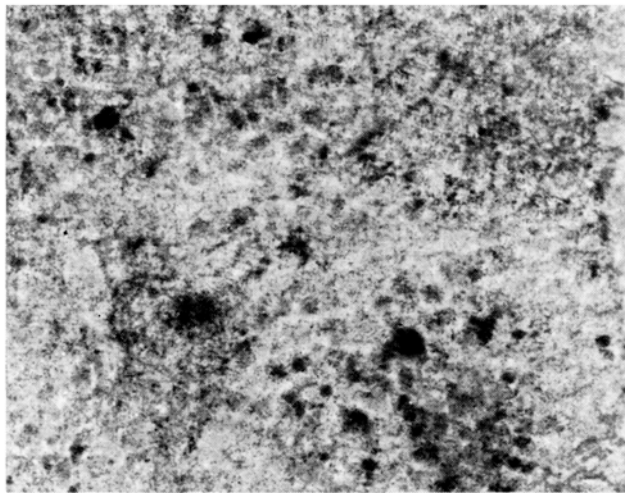
The melanin precursors and melanin are also present in the hepatopancreas. The developing oocytes also appeared to incorporate tyrosine and melanin granules, the latter, of course, was present in a very small number. But these oocytes contained within them larger quantities of sulfhydryl (SH) group than was found in the hepatopancreas. The SH group was also localized in the nucleolus of the growing oocytes. Sulfhydryl compounds are known to inhibit the production of black melanin by acting upon tyrosinase, the upshot of which in the present case is that though oocytes have requisites for the production of black melanin, the process is held in check by the presence of larger amount of sulfhydryl compounds. These compounds however allow yellow pigments to be formed instead of black ones that would otherwise be produced<sup>3</sup>. It has been noted that the manufacture of yellow pigments keeps paces with the development of the oocytes. This accounts for the yellow tinge of the mature oocytes.

Thus it is seen that hepatopancreas does play a role in the development of oocytes in so far as the supply of iron-proteins and the development of colour are concerned<sup>4</sup>.

**Zusammenfassung.** Das Hepatopankreas des Skorpions, *Palamnaeus bengalensis*, wurde untersucht, um herauszufinden, ob es Rohmaterial für die Entwicklung und Dotterbildung der Oozyten liefert. Es wird gezeigt, dass eine grosse Menge von Ferritin in der Leber gelagert und ausserdem in der sich entwickelnden Oozyte gefunden wird. Das Ferritin in den Oozyten ist auch direkt proportional zu ihrem Wachstum. Das Hepatopankreas scheint auch etwas Melaninkörner und Melaninvorstufen zur Entwicklung der in den Oozyten vorhandenen Melaninvorstufen zu liefern. Melaninvorstufen zusammen mit Sulfhydrylverbindungen bedingen eine gelbe Farbe der reifen Oozyten.

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Section through hepatopancreas of *P. bengalensis* showing the scattered granules of ferritin.  $\times 220$ .

<sup>1</sup> A. G. E. PEARSE, *Histochemistry* (Churchill, London 1960).

<sup>2</sup> J. H. LOCHEAD, *Encyclopaedia of Biological Sciences* (P. Gray, New York, London 1961), p. 475.

<sup>3</sup> G. CLEFFMAN, *Exptl Cell Res.* 35, 590 (1964).

<sup>4</sup> Acknowledgments. My sincere thanks are due to Dr. S. KESHAVA for the laboratory facilities provided.